INPUT OF ADVANCED ENERGY ECONOMY ON *TRANSITION TO THE FUTURE GRID* STUDY

NEPOOL Joint MC/RC Meeting

July 1, 2020

About Advanced Energy Economy

- AEE represents **more than 100 companies** and organizations that span the advanced energy industry and its value chains.
- **Technologies represented** include energy efficiency, demand response, solar photovoltaics, solar thermal electric, wind, energy storage, electric vehicles, advanced metering infrastructure, transmission and distribution efficiency, fuel cells, hydro power, advanced nuclear power, combined heat and power, and enabling software.
- Used together, these technologies and services will create and maintain a **higher-performing energy system**—one that is reliable and resilient, diverse, cost-effective, and clean—while also improving the availability and quality of customer-facing services.

Overview of AEE Perspective

Start now, and initiate **discussion of potential market reforms** simultaneously

Consider the **path from A to B,** not just what happens when we reach point B

Ensure analysis is robust and prioritizes **actionable insights** through an efficient process

AEE's input on the Future Grid Study - Sept. 2019*

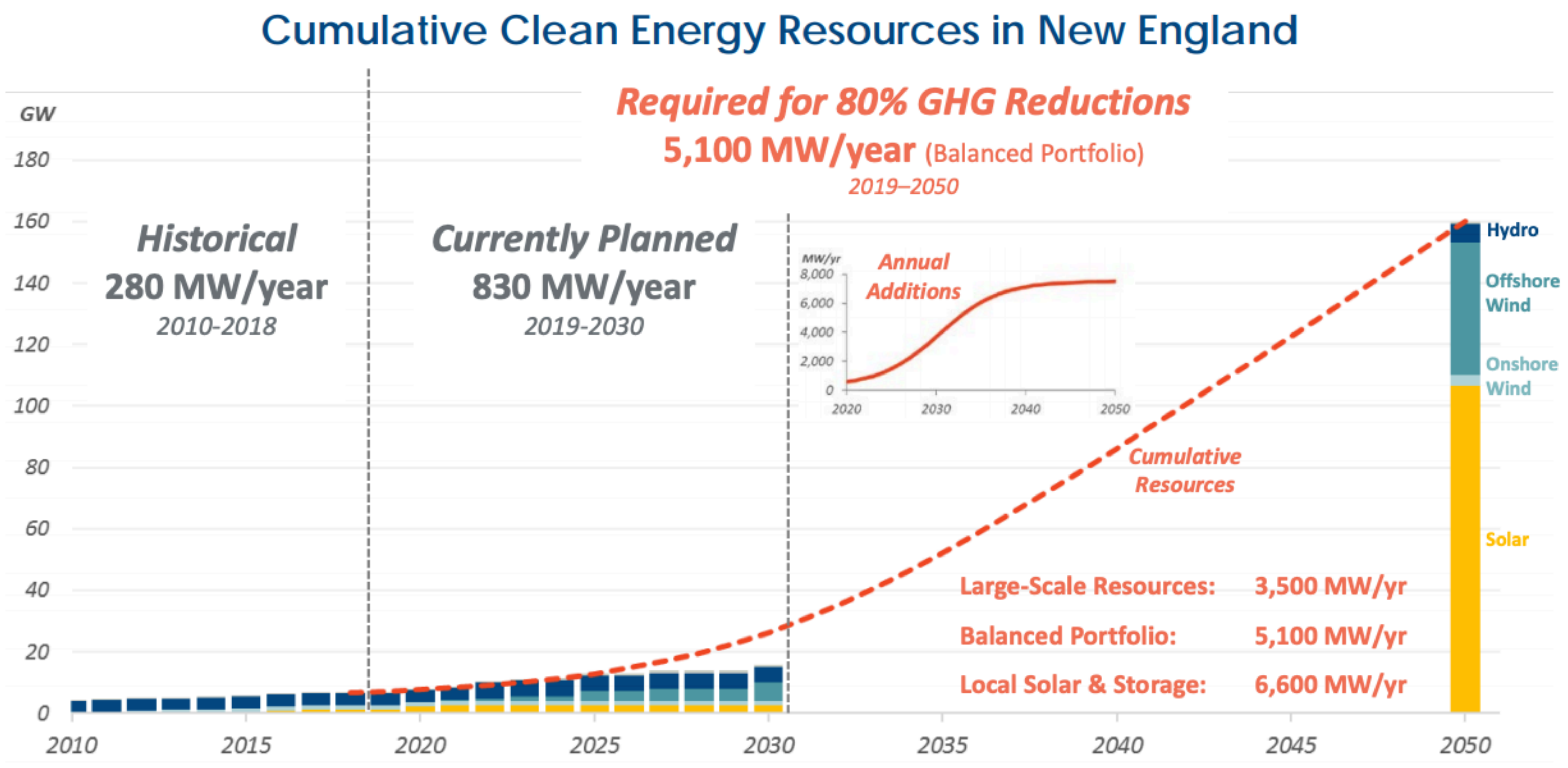
"As… market and policy drivers move the region to become more dependent on a mix of distributed energy resources, variable renewable energy generation, and load reduction and dynamic load shifting, ***it will be important to ensure that these and other advanced energy resources are able to fully participate*** in the [ISO-NE markets].

… as technology advances and the economics of the existing fleet change, ***a comprehensive look at barriers to participation faced by non-incumbent resources,*** in particular, will ensure that they are able to compete to provide all the wholesale services they are technically capable of providing and that a reliable system requires.

… as the resource mix shifts ***grid operators and planners may need different tools*** to maintain reliability in both day-to-day operations and long-term planning."

*Excerpts from letter to ISO-NE, shared with NEPOOL PC, emphasis added.

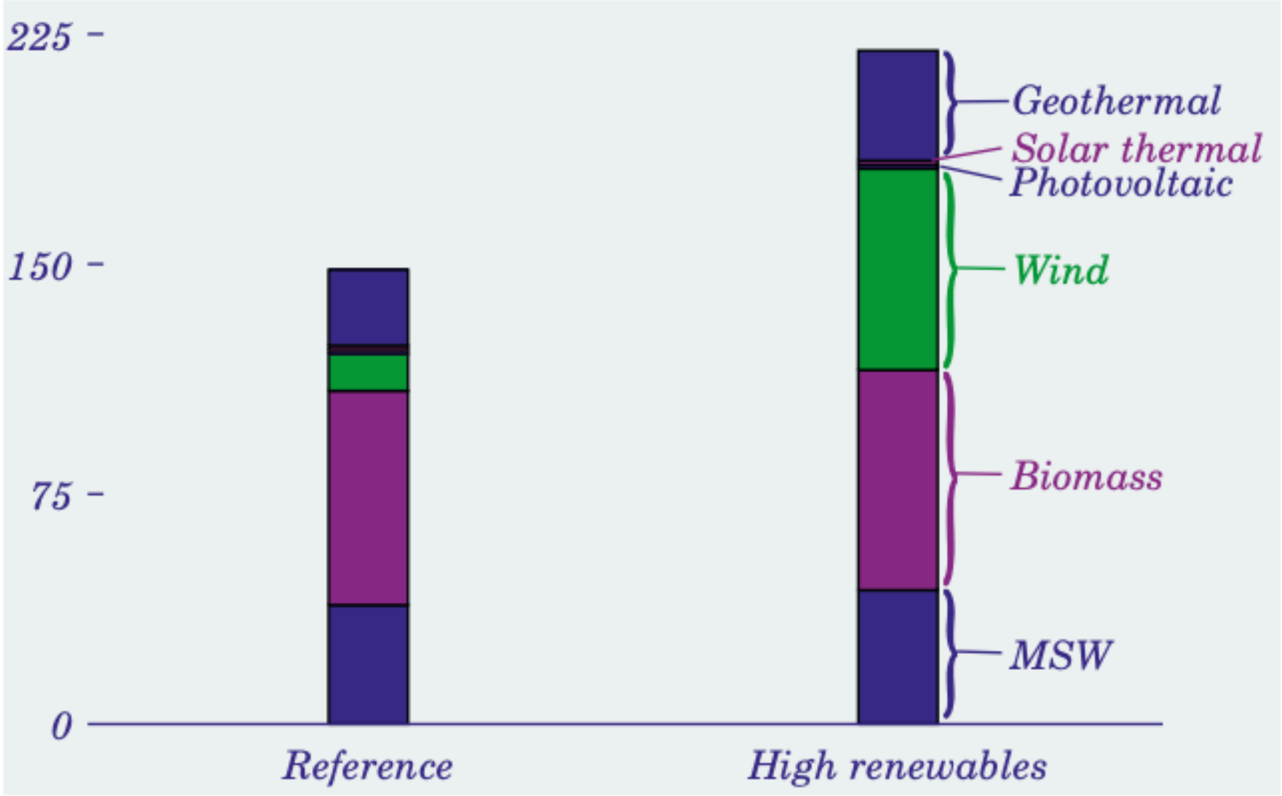
There is a path to 2050 goals, but it departs from BAU



Source: [The Brattle Group](#) (2019)

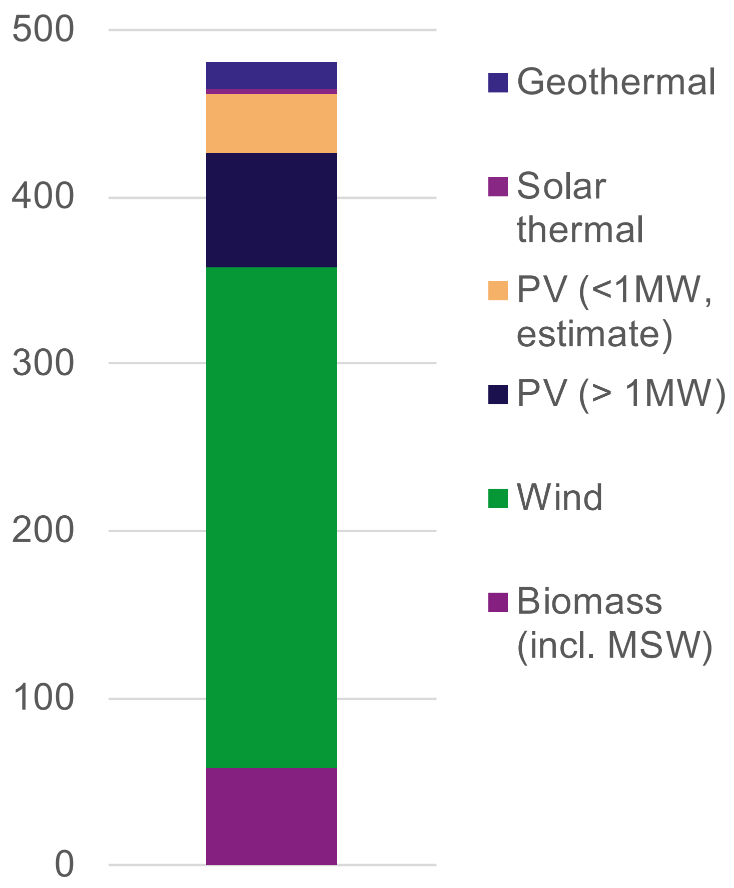
Good news: Technology consistently outpaces projections

Figure 82. Nonhydroelectric renewable electricity generation in two cases, 2020 (billion kilowatthours)



Source: EIA AEO 2000

Actual 2019 renewable electricity generation (billion kilowatthours)



Source: EIA 2020

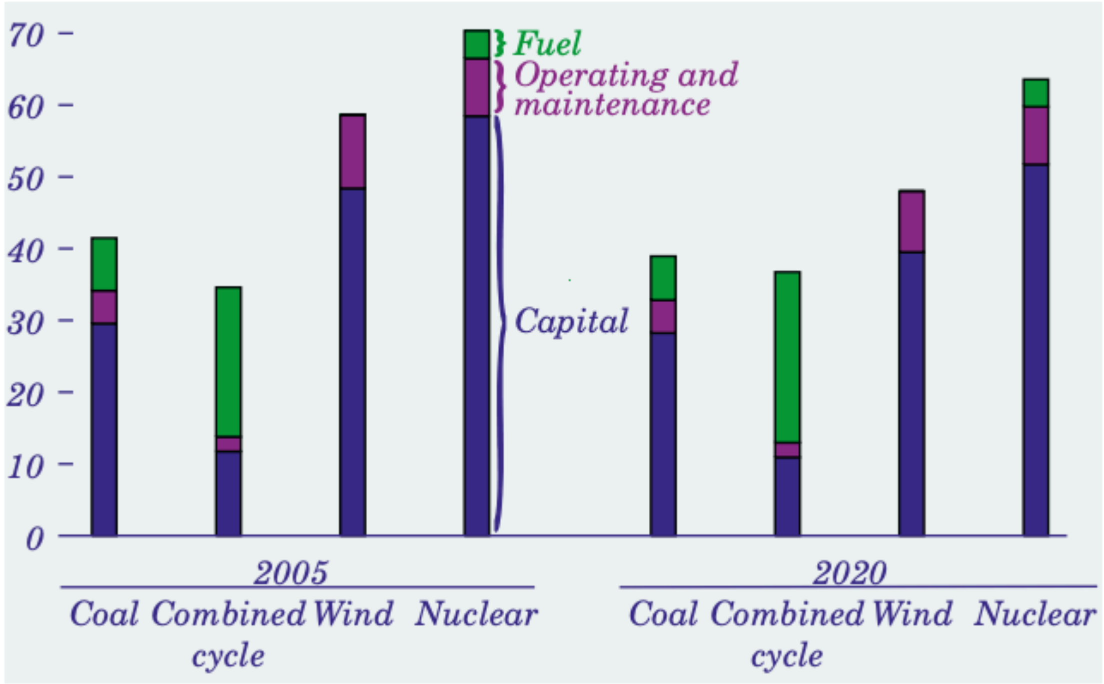
https://www.eia.gov/tools/faqs/faq.php?id=427&t=3

In 2000, EIA projected **12 billion kWh wind** and **1.3 billion kWh solar PV** in 2020.

Actual data from 2019 shows **300 billion kWh wind** and **104 billion kWh solar PV.**

Generation costs have also fallen faster than expected

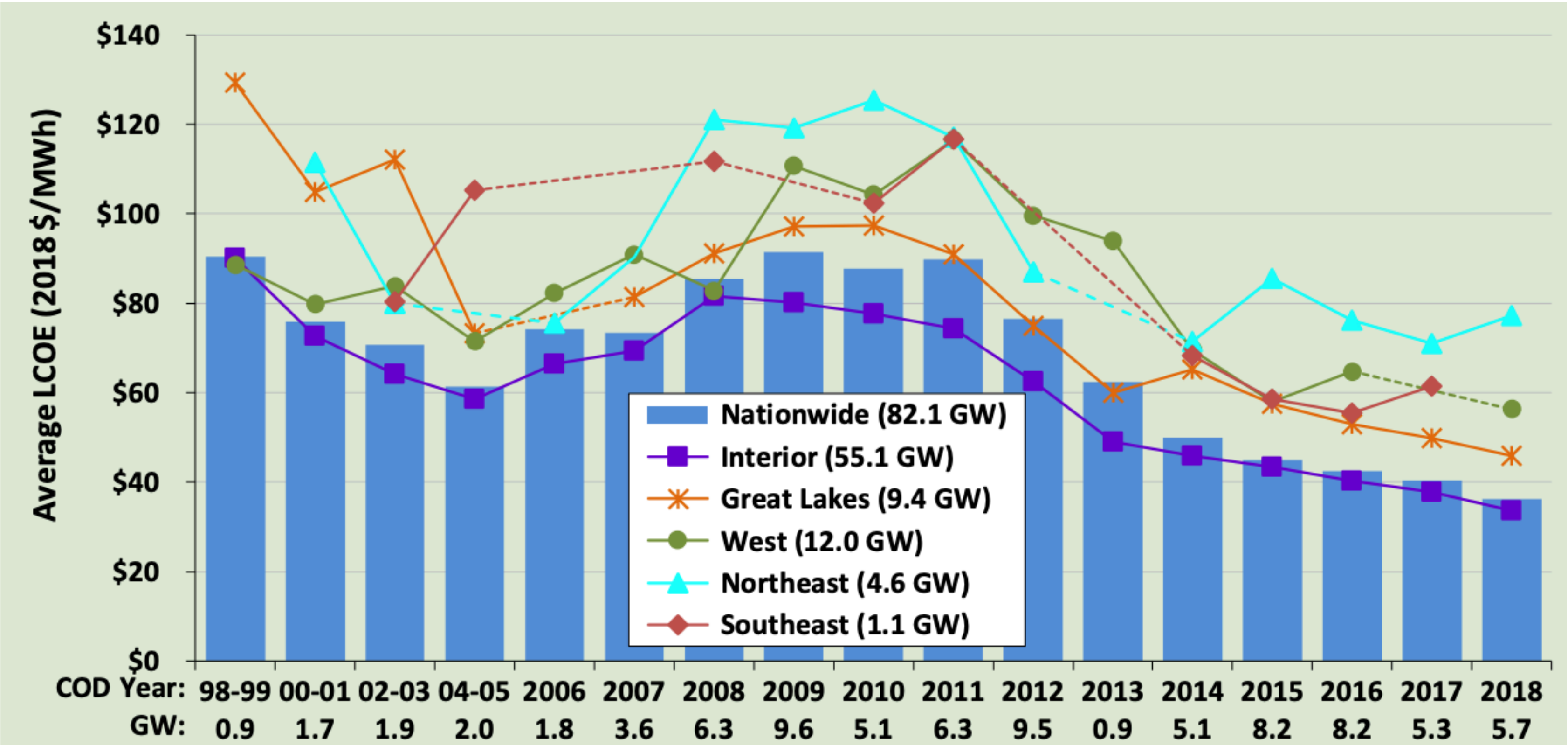
Figure 72. Electricity generation costs, 2005 and 2020 (1998 mills per kilowatthour)



Projected 2020 Wind Cost: ~$77/MWh (adjusted for inflation)

Source: EIA AEO 2000

Generation-weighted average wind LCOE values (excludes PTC)



Actual 2018 Wind Cost: ~$36/MWh

Source: DOE 2018 Wind Technologies Market Report

Meanwhile, technical capabilities have evolved

Service	Market Procured and Compensated Service?	Wind Can Technically Provide?[a]	Wind Currently Provides in U.S.?	Requires Pre-Curtailment for Wind to Provide?
Capacity	Y	Y	Y	N
Energy	Y	Y	Y	N
Inertial Response	N	Y	N/A	No[b]
Primary Frequency Response	Required but not compensated – proposals only	Y	Limited	Y
Fast Frequency Response	N – proposals only	Y	Limited	Y
Regulating Reserves	Y	Y	Limited	Y
Contingency – Spinning	Y	Y	Limited	Y
Contingency – Non-spinning	Y	Y	No	Y
Contingency – Replacement	Y	Maybe	No	Y
Ramping Reserves	Y (some locations)	Y	Limited	Y
Voltage Support	Y – cost of Service	Y[c] – location dependent	Limited	N
Black-Start	Y – cost of Service	Unclear, location dependent	No	N

Grid Services and Provision from Wind

Source: NREL 2019

- Studies show that inverter-based resources like wind, solar, and batteries *can* supply a range of grid services, if incentivized and integrated accordingly

https://www.nrel.gov/docs/fy19osti/72578.pdf

AEE's Key Question & Overarching Recommendations

Will the markets, as designed today, gets us to the future and meet future needs in a technology-neutral way?

1. Allow for study and discussion of the **transition** to the future, in addition to the end state
   - Gaps in market design to *maintain* a reliable system when a future resource mix is already in place likely differ from gaps or barriers to *achieve* that future mix
   - Could be studied as part of the Future Grid Study or in parallel
2. Provide for iterative, simultaneous discussion of **potential market reforms**
   - Study results will inform market reform discussions—the reverse can also be true if discussions occur in tandem
   - Reforms will take a long time to consider and implement; the process should start now
3. Ensure the study process produces **robust and actionable** results
   - Specific recommendations are outlined on subsequent slides

Specific Study Recommendations – Study Assumptions

- **Scenarios:**
  - All study scenarios should be consistent with achievement of current state policies
  - Some scenarios should assume that states will set *more* stringent targets
- **Inputs:**
  - Inputs should acknowledge the rate of technology change, which tends to outpace projections
  - Inputs should consider the potential for technical breakthroughs (e.g., Brattle's NYISO study uses RNG prices as proxy for a range of potential technologies, including hydrogen, flow batteries, gravity storage, and RNG)
  - Inputs should acknowledge the two-way impact of electrification of heating and transportation, i.e., consider both load *growth* and increased load *flexibility*

Specific Study Recommendations – Study Focus

- Identify **grid services and operational tools** needed to address reliability gaps, not specific technologies needed to deliver those services
  - A focus on services will allow for innovation, e.g., IBRs now provide various reliability services, and are technically capable of providing others
    - Frequency regulation offers a recent example of a grid service that has been defined and is now procured on a technology-neutral basis (FERC Order No. 755)
  - Should include assessment of whether markets are equipped to make full use of demand flexibility and demand-side resource participation
- Focus study on **developing new insights** needed to inform market reform discussions
  - Focus on the key questions (e.g., Gordon van Welie March 10 presentation)
  - Build on what we already know (as discussed by NESCOE May 27)
  - Trying to "intercept the asteroid" (Pete Fuller's May 27 presentation) will add time and complexity, and is not needed to identify market gaps

Specific Study Recommendations – Study Resources

- Rely on **studies already completed** and/or underway in New England
  - NESCOE May 27th presentation and NEPOOL Future Grid Library
- Incorporate **lessons from elsewhere**
  - How are other countries / regions handling higher penetrations of RE and DERs?
  - What ideas or technologies are being explored elsewhere?
  - NYISO study process: NYISO's initial *Grid in Transition* study identified near-term market gaps for stakeholder discussion, while The Brattle Group is working on a detailed longer-term analysis
  - MISO's Renewables Integration Impact Assessment (RIIA) is looking at the transition to increasing levels of RE over time to identify grid services and infrastructure needs

Questions / Contact

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